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EFFECTIVENESS OF BOTANICAL PESTICIDES AGAINST FALL ARMYWORM PESTS (*Spodoptera frugiperda*) ON RICE PLANTS

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ABSTRACT

Spodoptera frugiperda pests attack many food crops, including rice plants. Their larval life stage destroys rice plants and cause crop failure due to the attack rate, which can lead to yield losses of up to 80%. The study aimed to determine the effectiveness of botanical pesticides against fall armyworm pests and determine the concentration of botanical pesticides that are most appropriate to be used to control fall armyworm pest populations on rice plants. This research was conducted from May to July 2023 in the experimental land of Tonrong Rijang Village, Kacamatan Baranti, Sidrap Regency. The treatment of this study is P0 (control), P1 (100 ml botanical pesticide + 100 ml liquid soap + 800 ml water), P2 (300 ml botanical pesticide + 100 ml + 600 ml water), P3 (500 ml botanical pesticide + 100 ml liquid soap), P4 (700 ml botanical pesticide + 100 ml liquid soap + 200 ml water). The results showed that the application of botanical pesticides had an intangible influence on fall armyworm pests on rice plants due to the rain factor, which resulted in botanical pesticides being washed off, causing the application dose to be less than pestimal. The highest fall armyworm pest attack mortality at P4 is with an average of 100%, and the application of P1 doses shows the highest average attack intensity of 48.47% with a medium-scale damage category, this is because if the concentration of botanical pesticides is getting smaller, the intensity of fall armyworm pest attacks that occur on plants is also high.

Keywords: botanical pesticide, fall armyworm.

INTRODUCTION

Rice is the most important crop for almost mankind, because people still depend on this plant as the primary source of raw materials for daily life. Rice contains sources of energy and carbohydrates, besides that, the need for rice will continue to increase due to the significant demand for exports outside the region or Indonesia, especially to all small farmers in the territory of Indonesia [1]. Rice influences many aspects of social, economic, and cultural life. Rice and rice are still an essential part of the staple diet and even become a source of economy for most villagers. Rice is an essential and strategic group for Indonesian society, because currently, almost 90% of Indonesians depend on rice and rice [2].

[2] shows that crop production in Sidrap District in the last 5 years was 62.57 quintals/Ha in 2017, 58.27 quintals/Ha in 2018, 53.33 quintals/Ha in 2019, 50.26 quintals/Ha in 2020, 52.21 quintals/Ha in 2021. These data show that rice production results every year experience ups and downs in production. At the same time, obstacles can affect the decline in rice production, including pests and diseases that attack rice plants.

Pest is a plant nuisance organism, one of which is a pest that can cause low production in rice plants per hectare and can cause crop failure. Pest that attacks rice plants varies, one of which is fall armyworm pests (*Spodoptera frugiperda*), controlling and securing rice plants is not an easy thing; this is due to the delay in knowing the pest attack, so it affects taking action to overcome it and remembering the pest attack very quickly. So far, it is only used through eyesight to know the number of pest attacks in rice fields. Implementing integrated pest control is expected to improve and expand throughout the community [3].

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Fall armyworm pests attack many food crops, including rice, corn, soybeans, peanuts, sweet potatoes, and mustard. Fall armyworms are pests that can cause enormous losses to plant leaves, and fall armyworms have high plant-feeding power, so they can be called voracious pests [4]. This fall armyworm can damage rice plants and other crops because of the extent of the attack, which can result in yield losses of up to 80%. If not controlled, then this pest can result in crop failure. [5]. Because of the negative impact caused by fall armyworms, efforts are needed to reduce or prevent fall armyworm attacks. In general, farmers use chemical pesticides that harm the environment and make pests more immune, so the dose of pesticides must be increased, ultimately leading to higher costs. Therefore, innovation is needed to reduce the use of chemical pesticides that can cause losses in the long run. From these problems, an innovation was introduced, namely the use of vegetable pesticides that can be used to control pests and be more environmentally friendly [6].

In order to prevent losses due to fall armyworm pests in various areas in Sidrap Regency, farmers take control measures with chemical pesticides. Nevertheless, this effort has significant implications because chemical pesticides use a variety of harmful substances that can pollute soil and water, affect rice quality, and kill non-target organisms because of the death of natural enemies through the use of broad-spectrum chemical pesticides. These chemical pesticides make pests resistant or immune and experience more attacks than before pesticides were applied.

To control fall armyworm larvae pests without harming the environment, new technologies are needed to keep crops for agriculture sustainable and the country productive in the future. Using ingredients such as ginger, garlic, lime, and tobacco as environmentally friendly pesticides that control pests on rice plants. This natural pesticide is one of the efforts to reduce fall armyworm attacks on plants in agricultural areas. Vegetable pesticides are the use of secondary plant materials as active ingredients. These compounds act as repellents, exterminators, and appetite inhibitors for pests and cause discomfort for other pests. By using plant materials that are known to have the above properties, especially as active ingredients, it is hoped that vegetable pesticides can replace the use of synthetic pesticides, which can cause chemical residues on various agricultural products that are known to have various negative impacts on nature and surrounding life, can be reduced to a minimum the use of these chemical pesticides [7]. With this statement, the use of vegetable pesticides such as garlic, lime, ginger, and tobacco is one alternative; this plant has not been widely used by farmers, especially in the Sidrap Regency area. Some people do not know about using these plants where natural materials are often found in the community.

MATERIALS AND METHODS

Location and Time of Research

This research was carried out in the experimental land of Tonrong Rijang Village, Baranti District, Sidrap Regency, which was carried out from May to July 2023.

Materials and Tools

The ingredients used in the study were garlic 200 grams, ginger 200 grams, lime 200 ml, tobacco 200 grams, and liquid soap.

The tools used for research are knives, blenders, spoons, buckets, hand sprayers, measuring cups, clear plastic, bamboo, wooden blocks, breechcloths, triplex, shooting clips, cameras, and stationery.

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Manufacture of Botanical Pesticides

Botanical pesticides are made by pulverizing 200 grams of garlic, 200 grams of ginger, and 200 grams of tobacco in 3 liters of water using a blender. After crushing the mixture of the three ingredients, add lime juice as much as 200 ml. The mixture is put in a closed plastic bucket for fermentation for 1 week and filtered. For use, the mother liquor is mixed with water according to the treatment concentration, then each concentration is put into the hand sprayer.

Application of Botanical Pesticides

The application of Botanical pesticides is given according to the treatment; this spraying is done in the afternoon [8]. Botanical pesticides are sprayed when fall armyworms have been infested into plants, and application is done once a week.

Fall armyworm Propagation

a. Fall armyworm propagation begins with the search for fall armyworms larvae on rice plants. Once collected, then transferred to a prepared propagation container.
b. Multiply fall armyworms larvae, starting with a collection of at least 4 or 5 fall armyworms larvae and repeating 4 times, the container containing the larvae is closed using gauze so the respiration process can run well.
c. Fall armyworms larvae that have been obtained from the field are fall armyworms that are in the instar 5 phase in containers. Fresh leaves are provided as feed for larvae, if the leaves in the propagation container have run out or dried, they are immediately replaced with fresh leaves.
d. On the third day, it can be seen that the last instar fall armyworm larvae (instar 6) has become an inactive larva (pre-pupa). On day 6, fall armyworms have entered the pupa stage, and other larvae are still in the instar 6 larval stage.
e. On the eighth day, all fall armyworms larvae kept have entered the pupa stage. The pupa stage is initially light brown, but when the pupa becomes moths, it will become blackish brown.
f. At 9 days after the first larva becomes a pupa, it appears that the pupa has become an larvae and appears visible in every propagation container there is an image. In the container provided, the honey solution is used as feed for fall armyworm moths, the honey solution is placed on cotton hung in gauze, and the honey solution is given every 2 days so that cotton keeps the cotton from drying.
g. Three days after the image appeared, clusters of fall armyworm eggs were visible on gauze. They were round and light green; the almost hatched eggs turned brown and enlarged and looked like fish eggs.
h. Three days after the female moth lays the eggs, the eggs will hatch into fall armyworms larvae. Seven days after the eggs hatch, the larvaes are ready to be invested in rice plants.

Trial Design

This research activity used Group Randomized Design with 5 treatments, repeated 3 times so that there were 15 experimental units. Each experimental unit consists of 2 plant samples, so there are 30 experimental plant units for the following treatment:

P0 : No treatment (control)
P1 : Botanical Pesticide Ingredients as much as 100 ml + 100 ml liquid soap + 800 ml water
P2 : Botanical pesticides as much as 300 ml + 100 ml liquid soap + 600 ml water
P3 : Botanical Pesticide Ingredients as much as 500 ml + 100 ml Liquid Soap + 500 ml Water
P4 : Botanical pesticide emberian as much as 700 ml + 100 ml liquid soap + 300 ml water.

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The observation data is then analyzed using fingerprints, if there are analysis results that show a real difference, it will be continued with the Honest Real Difference (BNJ) at a level of 5%.

RESULTS AND DISCUSSION

Mortality Concentration of Fall Armyworm Larvae Pests

The results of observations and fingerprints of mortality attacks by fall armyworm pests show that the treatment of Botanical pesticides has a natural effect on fall armyworm pest attacks on rice plants.

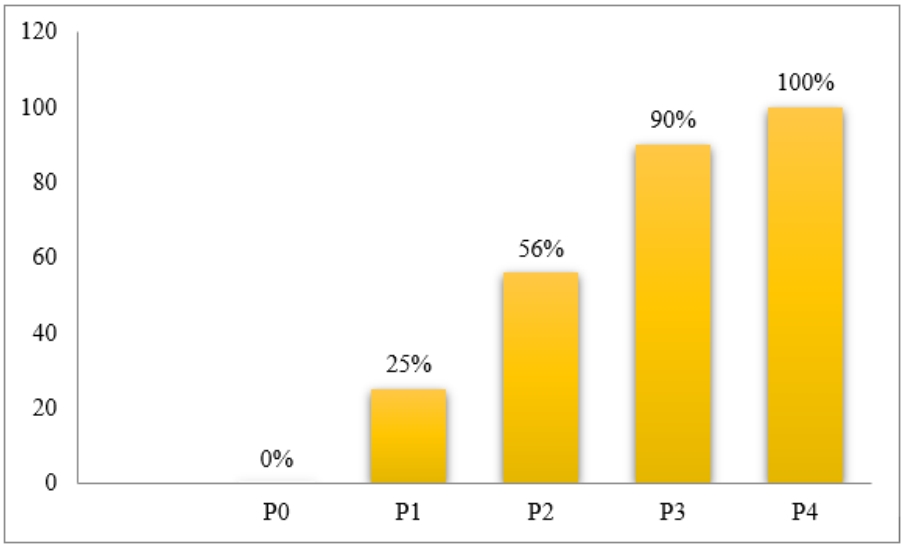

Figure 1. Diagram of the Average Concentration of Botanical Pesticides on Mortality of Fall Armyworm Pests on Rice Plants

The results of the diagram above stated that the use of Botanical pesticides showed the highest fall armyworm pest attack mortality in P4 treatment (700 ml of Botanical pesticides + 100 ml of liquid soap + 300 ml of water) with an average of 100%, then P3 (500 ml of Botanical pesticides + 100 ml of liquid soap + 400 ml of water) with an average of 90%, followed by P2 (300 ml of Botanical pesticides 100 + ml of liquid soap + 600 ml of water) with an average of 56.66%, the next results were followed by P1 (100 ml of Botanical pesticides + 100 ml + 800 ml of water) with an average of 25%, while those without P0 treatment (control) without treatment with an average value of 0%.

Fall Armyworm Pest Attack Intensity

The results of observations and fingerprints of the various intensities of fall armyworm pest attacks show that the treatment of Botanical pesticides has no real difference in the intensity of fall armyworm pest attacks on rice plants.

It can be seen that the use of Botanical pesticides shows the highest attack intensity seen in P1 treatment (100 ml Botanical pesticides + 100 ml liquid soap + 800 ml water) with an average attack intensity of 48.47%, followed by P2 (300 ml Botanical pesticides + 100 ml + 600 ml water) with an average attack intensity of 42.49%, followed by P4 (700 ml Botanical pesticides + 100 ml liquid soap + 200 ml water) with an average attack intensity of 16.26%, then followed by P0 (control) which has an average attack intensity of 25.97%, then the lowest intensity yield of P3 (500 ml of Botanical pesticides/plants) with a value of 16.26%.

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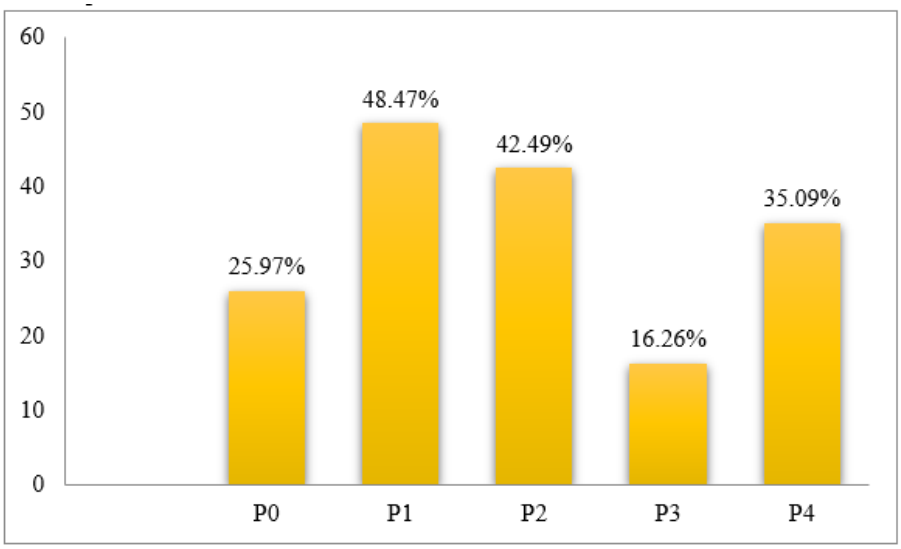

Figure 2. Diagram of the Average Presentation of Botanical Pesticide Application to the Intensity of Fall Armyworm Pest Attacks on Rice Plants.

It can be seen that the use of Botanical pesticides shows the highest attack intensity seen in P1 treatment (100 ml Botanical pesticides + 100 ml liquid soap + 800 ml water) with an average attack intensity of 48.47%, followed by P2 (300 ml Botanical pesticides + 100 ml + 600 ml water) with an average attack intensity of 42.49%, followed by P4 (700 ml Botanical pesticides + 100 ml liquid soap + 200 ml water) with an average attack intensity of 16.26%, then followed by P0 (control) which has an average attack intensity of 25.97%, then the lowest intensity yield of P3 (500 ml of Botanical pesticides/plants) with a value of 16.26%.

Based on the results of fingerprints, applying Botanical pesticides to fall armyworm pest populations on rice plants has an intangible influence on all parameters. The results of fall armyworm pest attack mortality parameters showed the highest concentration at P4 (700 ml of Botanical pesticides + 100 ml of soapy water + 200 ml of water), reaching an average value of 100%. According to [9], the higher the dose of Botanical pesticides used, the higher the toxic effect, or the more doses, the higher the mortality. This is because these Botanical pesticides contain nicotine made from tobacco. This statement is the same as that expressed by [10], who state that tobacco contains high alkaloids capable of being respiratory toxins, contact poisons, and nerve poisons so that they become effective in pest control. The content of garlic is an active compound useful for plants, namely acetogenin, which helps control and can also kill plant insects [11]. In addition, the content of lime is a limonene compound that makes insects uncomfortable. Ginger is an essential compound containing starch, resin, organic acids, oxalic acid, and ginger, which are repellent for pest attacks. [12] added that the effectiveness of Botanical pesticides is seen from the lethal level of test insects. Also, when pesticide ingredients are mixed, the active compound content will make other pests stay away, feel uncomfortable, and leave [13]. The results of the highest fall armyworm pest attack intensity parameters are shown.

P1 (100 ml of Botanical pesticides + 100 ml of liquid soap + 800 ml of water) with an average attack intensity of 48.47% in the medium scale damage category, while the lowest treatment was found in P3, which had an intensity of 16.26% in the mild scale damage category. This is because the application of different doses of pesticides is less than pestimal. The intensity of the attack increased because it was caused by a very low dose of Botanical pesticides and resulted in fall

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armyworms still actively eating rice leaves, which caused rice leaves to perforate or perforate and break. Therefore, the intensity of fall armyworm pest attacks and the provision of high concentrations of Botanical pesticides on plants is decreasing. The greater the concentration of Botanical pesticides, the smaller the intensity of fall armyworm pest attacks that occur on rice plants, the influence of this concentration is in line with the research of [14], the higher the concentration of Botanical pesticides, the higher the mortality of pests and will decrease the intensity of pest attacks. The large and low doses used will affect the intensity of fall armyworms, so it also affects the level of the remaining pest population, ultimately affecting the size of the damage caused [15]. This proves that the greater the concentration level of a chemical, the more active ingredients it contains, to the effect of a pesticide against fall armyworm pests.

CONCLUSION

Based on the results of this study, it can be concluded that the application of Botanical pesticides has an intangible influence on fall armyworm pests on rice plants because the doses used in each treatment are different, causing the application dose to be less than pestimal. The highest fall armyworm pest attack mortality in P4 (700 ml of Botanical pesticides + 100 ml of soapy water + 200 ml of water) is an average of 100%. Applying P1 doses (100 ml of Botanical pesticides + 100 ml of liquid soap + 800 ml of water) shows the highest average attack intensity of 48.47% with a medium-scale damage category. If the concentration of Botanical pesticides decreases, the intensity of fall armyworm pest attacks on plants is also high.

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